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LIFT AND DRAG CHARACTERISTICS OF A LOW-DRAG AIRFOIL WITH SLOTTED FLAP SUBMITTED BY CURTISS-WRIGHT CORPORATION

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MEMORANDUM REPORT

for

Materiel Division, Army Air Corps

LIFT AND DRAG CHARACTERISTICS OF A LOW-DRAG AIRFOIL WITH SLOTTED FLAP SUBMITTED BY CURTISS-WRIGHT CORPORATION

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INTRODUCTION

A 24-inch chord wooden model equipped with a slotted flap and submitted by Curtiss-Wright Corporation was tested in the Langley two-dimensional tunnel by request of the Materiel Division, U. S. Army Air Corps. The model represented a wing section of the P-60A airplane and was of, or approximately of, the NACA 66,2-118 section. The model was equipped with a 0.25c slotted flap with the lip on the upper airfoil surface at approximately 90 percent of the airfoil chord. This flap deflected in such a manner as to keep the slot closed until a deflection of over 15 degrees was obtained. The maximum flap deflection was nominally 30 degrees with an actual limit of 32.5 degrees set by the model construction. The model was equipped with pressure distribution orifices.

The tests reported herein were limited to measurements of lift and drag at various flap deflections because these measurements could be obtained quickly as compared with

pressure distribution measurements. Most of the data were obtained at a Reynolds number of about 6,000,000. Drag coefficients were obtained by the wake-survey method. Lift coefficients were obtained by means of an integrating lift manometer which integrated the lift reaction on the floor and ceiling of the wind-tunnel test section.[1]

RESULTS AND DISCUSSION

Lift characteristics obtained at flap deflections of 0, 5, 10, 15, 20, and 30 degrees are shown in figure 1 for a Reynolds number of about 6,000,000. A few points obtained near maximum lift are included for a flap deflection

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[1]At the time this report was originally published, some of the corrections required for reducing the test data to free-air conditions had not been determined. The values of section lift coefficient c_l given in figures 1 and 2 should accordingly be corrected by the equation

$$c_{l_{(corrected)}} = 0.993c_l + K$$

where the values of K are obtained from the following table

Flap deflection δ_f (deg)	K
0	0.001
5	.006
10	.013
15	.017
20	.022
30	.031
32.5	.032

of 32.5 degrees. A maximum lift coefficient of 1.51 was obtained with the flap retracted, and of 2.58 with the flap deflected 30 degrees. Increasing the flap deflection to 32.5 degrees increased the maximum lift coefficient to 2.67.

Tests at other values of the Reynolds number showed practically no variation of the maximum lift coefficient with Reynolds number between 3.0 and 7.5 million for a flap deflection of 30 degrees.

Drag coefficients are plotted in figure 2 against lift coefficient over the low-drag ranges for the various flap deflections. The data show that this flap is useful in extending the low-drag range to higher lift coefficients. All drag data presented for flap deflections of 5 and 10 degrees, and the lowest drag curve presented for a flap deflection of 15 degrees were obtained without any modification of the gap which appeared in the lower surface as the flap was deflected. At a flap deflection of 15 degrees, this gap increased in size to such an extent as to permit errors to appear in drag measurements made by the wake-survey method because of possible spanwise flow of low-energy air within the gap. Dams were accordingly inserted in the gap on each side of the survey station to prevent such spanwise flow, and check points were obtained at the high-lift end of the low-drag range. The drags thus obtained were

somewhat higher than those originally obtained. The gap was then completely filled and faired over. The drag in this condition was somewhat higher than that obtained in either of the other conditions. It is believed that the highest drags should be taken as the conservative ones for this flap deflection. Dams were placed in the slots to prevent spanwise flows for all higher flap deflections.

Langley Memorial Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Virginia, December 2, 1941.

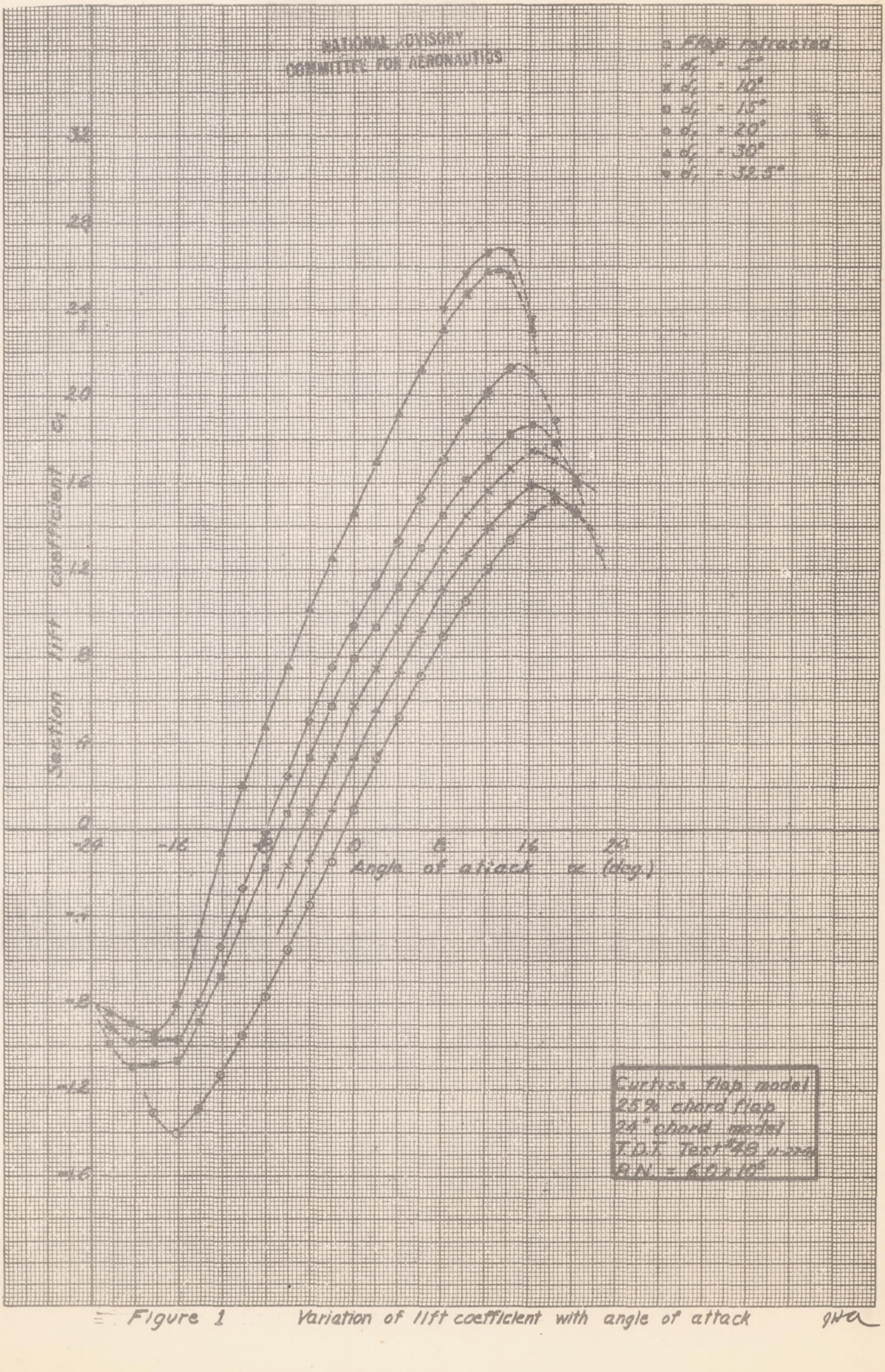

Figure 1 Variation of lift coefficient with angle of attack

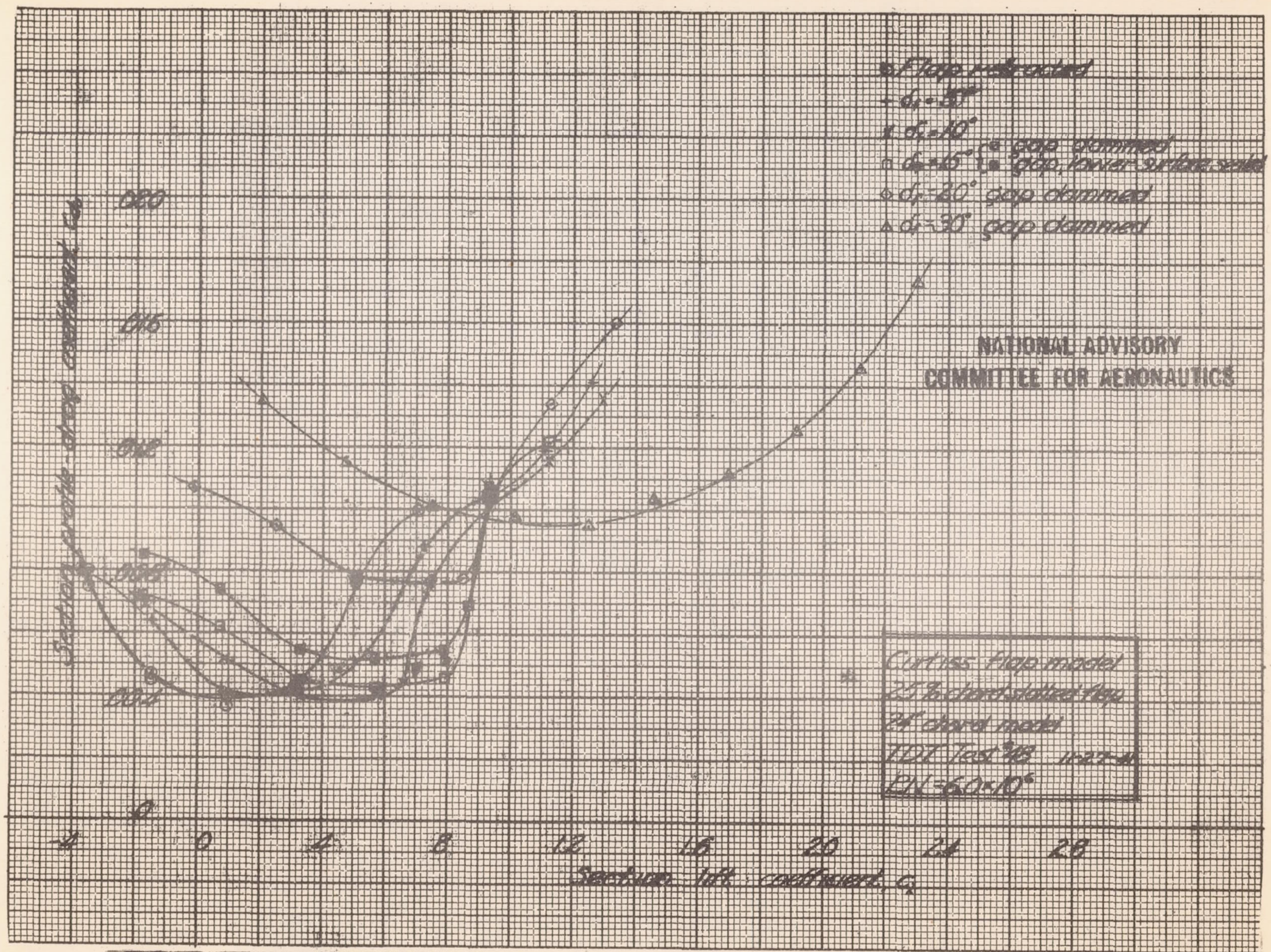

FIG. 2 Variation of section profile-drag coefficient with section lift coefficient

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